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13. ABSTRACT

Describes a method for evaluation of individual load carrying equipment operational and functional performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for preoperational inspection, physical characteristics, safety, personnel training, functional suitability, durability, reliability, maintainability, human factors, and value engineering. Applicable to packs, pouches, and frames.

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U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES

AMSTE-RP-702-109
Test Operations Procedure 10-3-023 2 June 1972

INDIVIDUAL LOAD CARRYING EQUIPMENT

SECTION I
GENERAL

1. Purpose and Scope.

a. Purpose.

This Test Operations Procedure (TOP) is published as a guide to be used in conducting an Expanded Service Test (EST) of Individual Load Carrying Equipment (ILCE). The procedure is applicable to the environmental conditions of the temperate zone.

b. Scope.

This document outlines a procedure, the results of which can determine, through a series of supporting tests, the suitability of a test item for general acceptance and subsequent entry into the Army inventory. The test item should be compared with standard issue items, and its performance measured and evaluated against criteria established in current requirement documents. The scope of testing should include, but should not be limited to the following:

(1) Adequacy of safety features.

(2) Extensiveness of instruction and training required to use the test equipment properly.

(3) Functional suitability and compatibility in relationship to normal Infantry combat and related tasks and functions.

(4) Capability of the test item to survive a determined period of extensive use and remain serviceable.

(5) Maintenance requirements.

(6) Soldier acceptance.

(7) Value analysis.

2. Background.

Modern concepts of battle tactics place increased emphasis on the mobility of troops. Improvement of battle efficiency by simplifying the ways and means of carrying the load of soldiers has been a continuing objective of military leaders. Since there are certain essential items of individual clothing and equipment which a soldier must carry in combat, it becomes increasingly important that a system for man-carrying these items be satisfactorily portable and durable. Further, the system must allow freedom of movement and be compatible with other standard items of clothing and equipment. Department of the Army (DA) directs this effort in its latest approved Qualitative Materiel Requirements (QMR) for a system of Lightweight Individual Clothing and Equipment (LINCLOE). Component pouches, packs and frames are normally designed with a stated maximum weight and volume limit. Any test procedure where the design limits could be exceeded will require special data collection to permit proper evaluation of failures which occur under overload conditions.

3. Equipment and Facilities.

a. Equipment.

(1) Test items and accessories.

(2) Control items as prescribed.

(3) Linear and weight measuring equipment.

(4) Infantry unit with TOE weapons and equipment.

(5) Paratroop unit with TOE weapons and equipment.

(6) Photographic equipment.

(7) Safety and first aid equipment.

(8) Tactical vehicles, air and ground.

(9) Appropriate crew served weapon units.

(10) Body armor.

(11) Communications equipment.

(12) Ammunition.

(13) Explosives.

(14) Grenades.

(15) Chemical munitions.

(16) Pyrotechnics.

(17) Decontamination equipment.

(18) Combat rations.

(19) Assault boat.

(20) Rappelling equipment.

(21) Mines.

(22) Stopwatch.

b. Facilities.

(1) Field training areas.

(2) Ranges.

(3) Water crossing site.

(4) Airfield.

(5) Confidence course.

(6) Mask confidence course.

(7) Bayonet and grenade assault course.

(8) Classroom, storage area, and office space.

(9) Instrumented test facilities, if available.

SECTION II
TEST PROCEDURES

4. Supporting Tests.

Common Service MTP/TOP, the tests defined in Section III, and other published documents to be considered in formulating an EST plan are as follows:

TEST SUBJECT TITLE	PUBLICATION NO.
a. Preoperational Inspection and Physical Characteristics (refer to para 5)	10-3-500
b. Safety (refer to para 6)	10-3-507

TEST SUBJECT TITLE	PUBLICATION NO.
c. Personnel Training (refer to para 7)	10-3-501
d. Functional Suitability (refer to para 8)	
e. Durability and Reliability (refer to para 9)	10-3-502
f. Maintainability (refer to para 10)	10-3-504
g. Human Factors Engineering (refer to para 11)	10-3-505
h. Value Engineering (refer to para 12)	10-3-505

SECTION III
SUPPLEMENTARY INSTRUCTIONS

5. Preoperational Inspection and Physical Characteristics.

a. The objectives of this testing are to verify the completeness of the candidate load carrying equipment received for the test and to compare its physical characteristics with the criteria established in appropriate materiel needs (MN) documents. A further objective is to determine whether each item made available for testing is in a serviceable condition and suitable for testing. The objectives of this supporting test can be met by accomplishing the procedures of MTP 10-3-500, which describes a series of tests to be conducted on newly arrived general supplies and equipment prior to service testing.

b. In the collection of data to support test findings, it is important that a tester isolate the when, where, and why of events, in addition to the final judgment of what happened. It is possible that a failure attributed to service testing may have been a by-product of poor shipping practices or improper handling prior to being received at the test site. Preoperational or intransit damage must be detected and recorded in order that test-faults determined are valid failures of testing and not the results of a pretest condition.

c. The physical characteristics of test items, as prescribed in the requirements documents, should be verified by close scrutiny during the preoperational inspection. Examples of characteristics that might be applicable to load carrying equipment are:

(1) The system must be complete with all components in serviceable condition.

(2) The maximum weight of the total system and each of its components.

(3) Physical properties of materials used, i.e., Rigidity, Pliancy, Elasticity, Brittleness, Fragility, Texture and other specific limitations.

(4) The number, size, and capacity of components designed to contain, hold, or support those items of clothing, equipment, ammunition, rations, water, or other mission items carried by the soldier.

(5) The color, texture, shade, or tone required of each component. This characteristic should express desired features of compatibility with other equipment, reflectiveness, and camouflage sanctions imposed.

(6) Design features required -- i.e., must facilitate tailoring of loads, easy to don or doff, provide quick attachment and release, shall not lose its functional characteristics as a result of laundering, cleaning, or decontamination.

6. Safety.

a. The applicable procedures of MTP 10-3-507, Safety, should be accomplished and a safety confirmation performed in accordance with TECOM Regulation 385-6, Verification of Safety of Materiel During Testing.

b. These procedures are accomplished to determine the effectiveness of the test equipment's safety features and to confirm the safety of the actual test item. Safety applies categorically to the test item, its components, and to other equipment associated with its use during the conduct of the test. The determination of the worth of safety features should be a continuing evaluation of observations, comments, and events concurrent with all testing.

7. Personnel Training.

a. The objectives of this subtests are:

(1) To familiarize test soldiers and other participants with all aspects of the test item.

(2) To furnish instruction in the assembly, configuration of loads, adjustments, and donning and doffing procedures.

(3) To orient personnel toward test objectives and to motivate their performance.

(4) To determine the adequacy of the training package received with the test item (if furnished), and to recommend measures for improving the program of instruction in those areas found inadequate.

b. A review of MTP 10-3-501, Operator Training and Familiarization, will furnish the test officer with procedures designed to accomplish the objectives outlined above. During the conduct of this phase, the test officer should ensure that the test soldiers' training is sufficient to make them as familiar with the test item as with the control item.

8. Functional Suitability.

a. Objectives.

(1) To determine the degree to which the test load carrying equipment allows or restricts the performance of a soldier in accomplishing his routine field or combat-oriented activities.

(2) To determine if the test item meets the functional criteria established in applicable requirements documents.

(3) To establish the degree of compatibility between the test item and other equipment worn, carried, or used by soldiers.

(4) To measure the degree of comfort and stability of the test gear.

b. Method.

A series of exercises should be performed. Each should afford an opportunity to observe the test equipment's performance under varying degrees of tactical and garrison-type stress and demands. The exercises should include, but not be limited to, the following:

(1) Field exercises conducted by a TOE unit over varying terrain. The exercises should emphasize the tactical employment of troops in a simulated combat environment with the test soldiers performing the combat tasks related to:

(a) The use of their organic weapons and supporting fires.

(b) The reconnaissance efforts required to observe, detect, locate and identify.

(c) The maneuvering of forces in the offensive and delay.

(d) The use of cover, concealment, and camouflage.

(e) The preparation of the battlefield (construction of fighting positions, clearing fields of fire, and construction of obstacles, to include wire types).

(f) The carrying of supplies, ammunition, rations, and equipment.

(g) Vehicular and air movements, to include the use of armored personnel carriers, trucks, and helicopters.

(h) The performance of specialized mission requirements such as mountain climbing and rappelling, heliborne rappelling and extraction, river crossing exercises, and ranger-type jungle swamp operations.

(2) Aerial Delivery, to include jump tower activities, parachute jumps, and other appropriate tests found in pertinent portions of TOP 7-3-511, Airdrop Operations.

(3) Crew-served-weapons drill and firing of appropriate weapons. These drills and firing exercises should be conducted by a representative number of soldiers wearing test equipment, while others perform like tasks wearing the control items. Weapons selected should be in the standard inventory, or those proposed for inventory which are available.

(4) Field firing of individual weapons. Selected test soldiers should fire on instrumented attack, defense, and quick-fire ranges, once while wearing the test gear, another time while wearing control equipment in the fighting load configuration in an effort to detect any variance in performance attributable to the wearing of the test load carrying equipment.

(5) Donning and Doffing Exercise. Test soldiers should conduct donning and doffing exercises, to include conversion from existence to fighting loads, with both test and control load carrying equipment. The soldiers should wear leather gloves with inserts, the M60 machine gunners vest, the M79 grenade ammunition vest, body armor, and other appropriate items to determine the compatibility of the test gear with other equipment.

(6) Soldiers equipped with the test load carrying equipment should be exposed to a CB exercise to evaluate the compatibility of the test item with CB protective clothing, equipment, and procedures. The exercise might consist of a CS attack while the soldiers are moving in an open column, carrying the fighting and existence loads with pack and frame. Troops should mask and cover with a poncho. The test soldiers should then be instructed to go into a fully protected posture, to include the CB overgarment, mask, hood and gloves, and to continue movement through a contaminated area. To complete the exercise, the test equipment should be subjected to field decontamination procedures using the standard decontaminating and reimpregnating kit.

(7) Confidence courses and the bayonet and grenade assault courses should be fully utilized to compare a soldier's running, jumping, climbing, throwing, and maneuver capability wearing the test equipment with his performance wearing the control gear in similar situations.

(8) The load carrying characteristics of the test gear should be evaluated by conducting an extensive foot march with test soldiers carrying loads of various weight and bulk.

(9) Test soldiers should participate in a motor march designed to create situations requiring frequent on and off loading. Half of the troops should wear the test item, the others, control equipment. Relative comfort and compatibility of the gear with motor movement tasks should be compared at the end of the march.

(10) A clothing and equipment test facility located at Fort Benning allows the collection of performance measures. Numerous procedures that are accomplished on this facility can be accomplished elsewhere without the need for extensive instrumentation.

c. Data Required.

(1) Subjective data will be collected through the use of questionnaires, interviews with test test participants, and observations of performance throughout the testing procedures. The scope of the collection effort should include:

(a) Flexibility and convenience of the system to accommodate items of clothing, equipment, ammunition, rations, water, and other appropriate soldier-carried items.

(b) Ease or difficulty of separating and carrying fighting and existence loads.

(c) Convenience of tailoring loads as required by climate, terrain, mission, hazards, and personal preference of command and individuals.

(d) Ease of loading and unloading, donning and doffing, and adjusting.

(e) Adequacy of straps, hooks, eyes, buckles and clips to provide load stability, and to facilitate comfort and fit.

(f) Adequacy of belt, its quick release capability, and its retention of fit after long periods of wear, wet and/or dry.

(g) Suitability of equipment to accept normal attachments.

(h) Compatibility of test equipment with clothing worn, weapons, or other loads normally carried.

(i) Compatibility of equipment to requirements generated by CB activity.

(2) Quantitative data should include:

(a) Time required for soldiers wearing test and control equipment to negotiate obstacle, confidence, grenade, and bayonet courses.

(b) Time comparisons associated with crew-served-weapons drills and firing exercises.

(c) Results of live-fire exercises expressed in time to first round hit, time to shift fire, hit probabilities, and questionnaire responses.

(3) All data should be supported with movies or pictures wherever appropriate.

d. Analytical Plan.

(1) Perform a subjective evaluation of data collected.

(2) Conduct an appropriate statistical analysis of the measures of effectiveness to determine any statistically significant differences between test and control items or test items and criteria. This should include:

(a) Mean times to complete obstacle, confidence, grenade, and bayonet courses.

(b) Mean times to complete crew-served-weapons drills and firing exercises.

(c) Mean times to complete donning and doffing exercise.

(d) Results of statistics obtained from firing exercises conducted on instrumented ranges.

(3) Conclude with a statement of the test equipment's functional suitability and any recommendations for modifications or improvement.

9. Durability and Reliability.

a. The applicable procedures of MTP/TOP 10-3-502, Durability should be accomplished. Throughout the conduct of the supporting tests, all failures and incidents which might have a bearing on determining if the

test equipment will last, in a serviceable condition, for a specified period of use while affording reliable service should be noted.

b. MTP/TOP 10-3-502 has been prepared as a basic guide to assist in examining durability during the testing of general equipment. The contents are broad in nature but adaptable to specific items undergoing tests. A careful review of all requirements documents, test directives, and local guidance should be made to ensure that specific durability requirements are thoroughly examined.

c. The Infantry unit with its TOE weapons and equipment undergoing the extensive field exercises required in the other supporting tests contained in this document will provide the type evidence of durability and reliability needed to support a judgment in this area. The cleaning procedures directed in appropriate field and technical manuals and other applicable instructions, a test for reaction to gasoline and insect repellent spillage, and other tests designed to accelerate the effects of mechanical and atmospheric degradation should be conducted concurrently with other tests.

d. Test supervisory personnel should note and record failures and evidence of degradation in test equipment throughout the progression of the tests.

e. Upon completion of all the supporting tests, each component of the tested equipment should be examined for serviceability. The number of serviceable items should be compared to the totals of items tested and a reliability judgment rendered. Reliability figures should be calculated at an appropriate confidence level for each component of the load carrying equipment. The overall durability and reliability of the system should be determined by an evaluation of critical component failures. (A component failure is defined as any discrepancy in a part which renders it unserviceable or less than fully functional.)

10. Maintainability.

a. The applicable procedures of MTP/TOP 10-3-504, Maintenance Evaluation, should be accomplished to determine if the maintenance directed in the instructions for use is adequate; if normal maintenance procedures are adequate to ensure serviceability; and if maintenance requirements meet the criteria established in materiel needs documents.

b. The maintenance evaluation portion of the expanded service test should be conducted concurrently with other testing whenever possible. The maintenance effort should be performed under the conditions normally associated with the equipment's use, by personnel with the proper MOS and using only those tools and items of equipment authorized at the maintenance level for the service being performed.

c. Information collected from interviews with test personnel, comments, observations, and pertinent data extracted from any questionnaires used should be recorded and evaluated. A comparison of the maintenance performance of the test gear with that of the control items and against known criteria should be expressed in the following areas:

(1) Frequency of user maintenance required.

(2) Failures.

(3) Time required to repair failures.

11. Human Factors Engineering.

a. The applicable procedures of MTP/TOP 10-3-505, Human Factors Evaluation, should be accomplished to determine if the equipment being tested is suitably engineered from a human factors standpoint.

b. Throughout the conduct of all subtests, subjective data pertaining to soldier acceptance, degradation of performance, and compatibility of the test equipment with soldier skills, aptitudes, and limitations should be gathered. The use of questionnaires, interviews, and observations noted by supervisory personnel are means of collecting such information. Comments of test soldiers concerning fit, comfort, compatibility, and relative performance of test and control items should be recorded in detail and a subjective analysis prepared to show areas of significance.

12. Value Engineering.

a. Objective.

To determine if the test equipment has any nonessential or costly features which could be eliminated without adversely affecting its performance.

b. Method.

Concurrent with the conduct of each subtest, participating personnel should be alerted and instructed to pinpoint and report any part of the test equipment which appears to be needless or superfluous.

c. Data Required.

The comments and observations of test participants.

d. Analytical Plan.

A subjective analysis of data collected should be prepared. The narrative should be supported with pictures, charts, or graphs where appropriate.

Recommended changes to this publication should be forwarded to Commanding General, US Army Test and Evaluation Command, ATTN: AMSTE-ME, Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the United States Army Infantry Board, STEBC-MO-M, Fort Benning, Georgia 31905. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No) printed on the first page.

APPENDIX
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